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West Europe Report

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No. 18

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CONTENTS PAGE

FEDERAL REPUBLIC OF GERMANY

Study Shows Wind Energy Feasible, Economical in Germany
(Karl-Heinz Preuss; FRANKFURTER RUNDSCHAU, 9 Feb 80).... 1

Wind Energy Gaining Popularity
(DER SPIEGEL, 25 Feb 80)..... 4

Blue Algae Used To Produce Hydrogen in Biological System
(FRANKFURTER RUNDSCHAU, 9 Feb 80)..... 9

Bonn To Fund Updating of Small Production Lines
(SUEDDEUTSCHE ZEITUNG, 30 Jan 80)..... 11

FRANCE

Analysis of French Civil Aviation Equipment Industry
(AVIATION MAGAZINE INTERNATIONAL, 1-14 Feb 80)..... 13

Standards, Qualifications for Researchers Announced
(AFP SCIENCES, 24 Jan 80)..... 25

Open Letter From Researchers To Prime Minister
(AFP SCIENCES, 24 Jan 80)..... 26

Some Decisions Necessitated by New Energy Policy
(AFP SCIENCES, 24 Jan 80)..... 27

ITALY

Alfa Romeo Markets Turbocharged Diesel Car
(ATA, Nov 79)..... 28

STUDY SHOWS WIND ENERGY FEASIBLE, ECONOMICAL IN GERMANY

Frankfurt/Main FRANKFURTER RUNDSCHAU in German 9 Feb 80 p 13

[Article by Karl-Heinz Preuss: "Chances for Wind Energy Better Than Expected"]

[Text] In theory, northern Germany could supply the entire FRG with electricity produced from wind energy. If all the areas in this region that are affected by the wind availability were to be fully utilized, 25,000 structures would have to be erected with a potential capacity of 3 megawatts each. As a comparison: The high-tension network of 110 kilovolts and above in the territory of the north German Laender of Schleswig-Holstein, Hamburg, Bremen and Lower Saxony, reaching a total length of approximately 17,000 kilometers, currently uses 50,000 high-tension poles. A maximal construction of such proportion, corresponding to the technically available potential, could produce a supply of wind energy that would equal the total consumption of electricity in the FRG in 1977.

Although ideas like that are unrealistic because the technically available potential is by no means identical with the economically feasible, the most recent studies indicate that the chances are better than has been assumed to date for large-scale technical utilization of wind energy in the FRG. The study that was commissioned by the FRG Ministry for Research and Technology (BMFT) and conducted by the University of Regensburg, under participation of several electric companies, is based on the technological concept of the large-scale wind-energy plant of GROWIAN, a prototype of which--GROWIAN I--is being erected in the Kaiser-Wilhelm-Koog near Brunsbuettel on the west coast of Schleswig-Holstein. Construction will begin as early as summer 1980.

The structure contains a cockpit like an airplane at a height of 100 meters and a two-blade rotor of 100 meters in diameter as well. The tips of the blades, reaching a height of 150 meters, stretch almost as high as the spire of the Cologne Cathedral. It is an impressive structure that is supposed to demonstrate within a 3-year trial operation whether and under which conditions it will be technically and economically feasible to use wind-energy installations of this magnitude for the supply of electricity to the public.

At one location in the north German coastal region, the energy produced by GROWIAN, which has a potential capacity of 3 megawatts, averages approximately 12 gigawatt hours over a 12-month period. It would supply the annual energy needs of 250 single-family homes--including heat--or 4,000 households with electricity or conserve 3.5 million liters of fuel in an oil-burning power plant. Nevertheless, producing energy from wind in amounts that would equal the capacity of a large power plant would require that 100 or more wind wheels be connected into one distribution system. Consequently, the model calculations of the Regensburg study are proceeding from the assumption that, in principle, wind power plants are operated as an interconnected system covering the entire north German coastal region. According to this principle, an "individual wind power plant" would be a local combination of 100 installations of the type known as GROWIAN. It would be equal to a 300-megawatt wind power plant.

According to the investigations by the Regensburg scientists, the annual average of wind velocity in this region relevant to energy production is approximately 8 meters per second, measured at a height of 100 meters where the hub is. Particularly favorable is the wind supply in late fall and early winter, that is at times of increased energy demand. Prolonged calm periods occur primarily during the summer, when the demand for energy is less anyway.

The study reaches the conclusion--assuming similar meteorological conditions--that the geographic expansion of the wind-energy system, the size of the network that is to be fed with wind energy, as well as the number of installed wind power plants are of crucial importance to the expected savings in energy as well as the savings in installed conventional power plant capacities per wind power plant. In the process, the reduction in the cost of fuel--the savings rate rises until it reaches a certain saturation limit that is almost proportional to the installed wind power capacity--is drastically greater than is the case when conserving conventional power plant capacities. For reasons of supply guarantees and because of the irregularity of available winds, it is really not possible to do without conventional power plant capacities, except for a relatively small proportion.

An expansion of the network that is to be fed with wind energy, for instance, will lead to a significant increase in the conservation of installed conventional power plant capacities. If, on the other hand, wind energy is only fed into the relatively small coastal network, wind-energy production will frequently surpass the demand that may exist at a given time after 15 or more 300-megawatt wind power plants have been installed and a growing portion of the wind-energy production will remain unused. Furthermore, too high a proportion of wind power plants among all installed power plant capacities and the feeding of its energy into the entire network can reduce the economic competitiveness of wind power plants. It is particularly the case when the proportion exceeds 25 percent. In this case, wind-energy production will at times exceed the demand for energy even for the entire FRG network.

The process of feeding the entire FRG network involves 20 300-megawatt wind power plants, corresponding to 8.2 percent of all the installed capacities; the amount of energy produced is 19 terawatt hours, satisfying approximately 7 percent of the demand for electricity, and at a 1,500 megawatt capacity approximately 2.2 percent of conventional power plant capabilities are being replaced without reducing the prescribed supply guarantees. In 1977, comparable energy production was supplied to public utility companies by water power plants, providing 15 terawatt hours, and oil-burning power plants, providing 17 terawatt hours. According to current findings it appears that this amount would be attainable at the very least.

Forty 300-megawatt wind power plants, amounting to 15.2 percent of the total installed capacity, are producing 38 terawatt hours and satisfying approximately 14 percent of the demand for electricity, and at 2,160 megawatts they would save approximately 3.2 percent of the installed conventional power plant capacities. Judging from consumption in 1977, nuclear power plants in the FRG produced a similar amount of energy for public utilities, at a rate of 35 terawatt hours. Wind-energy production was surpassed by gas power plants that produced 30 percent more with 49 terawatt hours, hard-coal power plants produced 70 percent more using 64 terawatt hours and brown-coal power plants produced 120 percent more with 84 terawatt hours.

According to the study, the figure of forty 300-megawatt power plant installations, i.e. 4,000 wind converters of the GROWIAN type, corresponds to "a relatively conservative assessment of expansion opportunities in the north German coastal region." At 35,000 square kilometers, this area comprises 14 percent of the FRG territory. No more than approximately 70 square kilometers, that is 0.2 percent, would actually have to be used for the "construction of wind power installations."

The study arrives at the following conclusion: In spite of the fact that proportionate savings in conventional power plant capacities are relatively small, wind energy--when compared to other energy carriers--is economically feasible already today, even if only considering the commercial aspects, if the actual investment costs for the first commercial wind power installations of the GROWIAN type do not exceed DM 15.9 million and if it is possible to affect an additional reduction to less than DM 9.6 million by calling for a mass production of 4,000 installations. The competitiveness is increased when additional social costs are taken into consideration, since they should be lower for wind energy than for traditional competing energy carriers.

8991
CSO: 3102

WIND ENERGY GAINING POPULARITY

Hamburg DER SPIEGEL in German 25 Feb 80 pp 67-70

[Article: "Miller's Wind"]

[Text] Electric energy from domestic power stations, heat from the air: Increasingly, builders make use of wind energy--and find themselves up against the authorities.

When the wind blows across the dikes on the Schleswig-Holstein peninsula of Eiderstedt on the North Sea, Gerhard Nachtigall, physician, farmer and presently pensioner, "takes hot baths all the time." For during periods of strong wind, there is hot bath water in abundance at Nachtigall's Katharinenheerd farmstead: Two wind wheels attached to 11-meter posts drive generators, which produce the power that heats the water and also an oven. Whenever there is a fresh breeze, this oven produces "wind-baked goods"--white and black bread, which Nachtigall bakes for his friends and his own consumption according to old recipes ("no additives").

Another "wind use pioneer" (Nachtigall on Nachtigall)--and an inventor to boot--is the old Norderstedt farmer Henri Luedemann: Using scrap metal, an old oil tank, a stripped dishwasher and obsolete trolley-line standards, he designed and built two wind generators with an output of 2 and 3.7 kilowatts, respectively. Like Nachtigall, who draws from the winds above Eiderstedt an annual volume of heating power equaling "approximately 2,500 liters of oil," the Norderstedt farmer converts the output of his wind generators through a kind of immersion heater in a hot-water tank. In addition, he uses the wind energy to run an emergency lighting system for his farm.

At the thatched farmhouse of Johanna and Willi Schroeder, a married couple in the village of Seestermuehe in the Elbe marshes, a wind generator, which was installed last fall and which at a height of 15 meters towers over the walnut trees in the garden, keeps the swimming pool--dimensions 4 by 10 meters--at a temperature of 26° C. However, it was not pioneering or

inventing spirit that prompted the Schroeders to make a DM 30,000 investment; rather, the pool owners felt that--as Johanna Schroeder, who holds a doctorate in biology, put it--"Mr Khomeyni is not to be trusted" and that, with the energy supply dwindling, "private swimming pools may be outlawed."

For like biogas, power from solar collectors or geothermal energy, the production of energy by means of windmills is no longer a privilege of crackpot tinkerers or nature apostles. The Federal Ministry for Research and Technology estimates that aside from research and pilot installations, there are approximately 40 farms, located for the most part in windy North Germany, which produce power for domestic use by means of 2-, 3- and even 8- and 10-vane wind converters.

Three hundred mill fans, mill owners and professional mill builders recently established the "German Wind Energy Association"; according to their chairman, the Wilhelmshaven lawyer Dr Ivo Dane, they are "fed up with the electricity and oil price dictates of the power companies and multinational concerns." In over half a dozen legal proceedings, the lawyer is presently representing frustrated windmillers against "unreasonable parties," i.e. state agencies which refused to grant building permits to the power savers.

Likewise past the half-dozen mark is the number of domestic manufacturers of wind-power units, who recommend their products to courageous builders for domestic use. Among them are small-scale entrepreneurs such as Fritz Huellmann of Tornesch, Holstein, who employs a crew of six, but also machine building concerns such as MAN [Augsburg-Nuernberg Machine Building Co.] The Tornesch firm offers--at a price of DM 18,000--a unit with a rated output of 5 kilowatts; the firm claims that with this unit it is possible "under the most favorable conditions to realize oil savings of maximally 2,500 liters per year." For DM 50,000, there is a 10-kilowatt unit, the "Aeroman-10," which is produced by MAN and marketed under the slogan: "With wind into the future."

Within the framework of its energy development program, the Federal Ministry for Research and Technology has allocated approximately DM 1.4 million for a research project aimed at "determining the wind energy supply in the Heligoland Bight and the North German Plain." Hauff's ministry is spending approximately DM 42 million on the ambitious "Growian" (Large-Scale Wind Energy Installation) demonstration project: The biggest windmill in the world--almost as high as the Cologne cathedral, output 3 megawatts--which will be erected by 1982 on Kaiser-Wilhelm Bay at the mouth of the Elbe River and which is to provide data for large-scale wind energy projects.

According to Soeren Fries, an engineer affiliated with the Society for the Utilization of Nuclear Energy in Shipping and Ship Building (GKSS), the same fund will finance "a kind of product test" for wind generators for domestic use which are presently being marketed. In March, the GKSS plans to install on the North Frisian island of Pellworm nine wind generators of

various makes, but identical output. If they do not fall to pieces beforehand, the mills will be subjected to comparative 2- year tests in the salty North Sea air.

For in spite of the fact that the wind wheel has a history of approximately 1,500 years--ranging from the mills of the Persians in the 7th century to the wooden marvels of the Dutch in the 18th century and the multivane rotors that are part of practically every western--wind pioneer Nachtigall states on the basis of the experience gained in running his two wind-power units that he feels "like an automobile owner of 1910, when it was necessary for the owner to take the driver along," for "things are not fully developed yet."

Like the fathers of the automobile in their time, the wind enthusiast still have a lot of experimenting to do; and no one can say which method of tapping the wnnd will eventually be the most advantageous.

The experts, for example, distinguish between low-, medium- and high-speed units. Low-speed rotors are equipped with seven or more vanes and their rotational speed is low. They are regarded as robust and due to their large overall sail surface, they start rotating in relatively light winds; however, their performance does not increase in strong winds.

The high-speed rotors have two or three vanes, and sometimes only one, in which case they are equipped with a counterweight; whereas they do not start in light winds, their performance increases significantly in strong winds and they reach a high Cp-value, i.e. the call fill measure which indicates what percentage of the wind energy is transferred by the rotor to the drive shaft. A four-vane Holland mill, for example, can reach a Cp-value of 33 percent, whereas the optimally formed and adjusted two-vane rotor of a high-speed unit attains 48 percent.

In addition, there are rotors which do not rotate around a horizontal axle; in these units, the axle is vertical and the rotor consists of several superimposed vane wheels resembling the ventilators on the roofs of refrigerator cars.

As diverse as the possibilities of tapping the wind energy are the ways of using this energy. By the classical method, the alternating current produced in the wind generator is conducted via a rectifier to a battery accumulator, from which it is fed into the power supply system.

Technologically far less costly, but at the same time more energy-productive is the direct method: Through a heat exchanger, the power generated by the rotor heats the bath and radiator water in the home.

Theoretically, it would be possible to obtain from the same quantum of wind energy twice as much heat as is produced through the heat exchanger, if that energy is used to drive the compressor of a thermal pump, which then produces hot water.

On the other hand, it is also possible to short-circuit the flow of energy from the wind to the hot water. The Federal Ministry for Research and Technology recently granted the Pinneberg ventilator producer Hans Witt a subsidy of DM 390,000 to be used for the development of a wind-powered hydraulic brake. Its principle: A wind wheel drives a second rotor which spins in a water tank and thus has a braking effect on the first rotor. As is the case in any braking action, the friction converts kinetic energy into thermal energy; the whirling water heats up and now can transmit heat to other systems, e.g. a central heating system.

But even if the wind technologists are able--sooner or later--to get past the designing and testing stage, it is unlikely that anybody would as yet be released from the dependence on multinational concerns and energy monopolists, which is the hope of the members of the "German Wind Energy Association."

For as any miller of old knew only too well, sometimes it is windy and sometimes there is a--possibly extended--lull. And this truth applies to the present wind-power installations of the energy-conscious home owner as well as to the Growians of tomorrow. According to a report prepared for the Ministry for Research and Technology, it would certainly be possible to build in the windy coastal regions of Germany so many superwindmills of the Growian type that approximately 7 percent of the present energy requirements would be met. Nevertheless, these mills could replace merely 2.2 percent of the present conventional power plant capacity; that is to say: A considerable percentage of the power plant capacity would have to be kept in reserve for the windless days.

Even now, some of the producers of wind generators for domestic use could easily get out of breath. For example, according to Edmund Gerhardt, the technical director of the Huellmann firm, people "take a great and increasing interest" in the firm's mills, but none of the potential customers are prepared to buy, for "the people probably are somewhat disturbed."

Since the building regulations do not contain any provisions specifying under what conditions private wind units may be installed, the licensing agencies increasingly make things difficult for individuals planning to build. Increasingly, the authorities use environmental protection arguments to stop the proponents of the environmentally harmless wind energy. Thus the Hesse municipal and district authorities have been instructed by the highest licensing authority, the Construction Department of the Ministry of the Interior, "strictly to use their regulating powers," since, as Ministerial Councilor Fritz-Heinz Mueller put it, windmills "interfere with the uniform configuration of a place."

District supervisors and presidents refused to grant a hotel owner in Muetzenich, Eifel, the building permit for a 31-meter, three-vane rotor, since it would be an "alien body" in the scenery. The Administrative Court supported this decision: The rotor would destroy "the natural

characteristics of the landscape." The same administrative court commended an Eifel windmiller, who had been stopped by the district authorities, for the "pioneering spirit" he showed "in overcoming by unusual means the energy problems concerning all citizens," but did not grant him the permission to build. The man submitted his case to the appellate court.

Again, out of concern for the "natural characteristics" of the scenery, the district agency objected to the high-speed rotor--12 meters in diameter--by means of which a woman home owner in Osterholz-Scharmbeck, Lower Saxony, wanted to reduce her heating costs. Her case was upheld by the Administrative Court: The judges of the Stade First Board of Appeal of the Oldenburg Administrative Court found themselves "unable to state that in itself a small-scale wind-energy installation is ugly." They also pointed out that the area in which the plaintiff wants to build her high-speed rotor "had formerly been--on account of its exposed location--the site of several windmills."

Should this argument meet with general acceptance, no mill builder could be denied a license. One hundred years ago, when wind energy was used for grinding grain, there were over 10,000 windmills in the North German Plain alone.

8760
CSO: 3102

BLUE ALGAE USED TO PRODUCE HYDROGEN IN BIOLOGICAL SYSTEM

Frankfurt/Main FRANKFURTER RUNDSCHAU in German 9 Feb 80 p 13

[Article: "Blue Algae as Producers of Hydrogen: Energy Research in New Directions"]

[Text] DFD. A principle of energy conversion which has proven itself in nature for millenia, the conversion of sunlight into chemical energy during photosynthesis, could revolutionize energy production. Through intervention in the photosynthesis apparatus of algae and green plants the production of technically usable hydrogen gas is possible. This is demonstrated by experiments in the energy research center of the University of Konstanz. The chances for obtaining hydrogen in a biological system are, however, also being studied in other laboratories of the world.

To facilitate this biological path to obtaining energy, nature, it is true, must be tricked a little bit: Normally the plant prevents the formation of hydrogen, desired by the biologists, in order to be able to produce biomass undisturbed. During photosynthesis with the aid of sunlight sugar is formed from the carbon dioxide of the air and from water, which is again the basic material for the biosynthesis of starch, cellulose and protein. In this process the electrons of water are built into the carbon dioxide of air, for which reason the development of free hydrogen and the building up of plant biomass are mutually exclusive.

Therefore the complicated machinery which is necessary for the production of biomass, the growth of the cell, is simply "uncoupled," while the corresponding menbrane-bound part of the photosynthesis apparatus is dissolved out of the cell. Thereby, as Prof Peter Boeger of the University of Konstanz reported to UMSCHAU IN WISSENSCHAFT UND TECHNIK, the "utilization" of the electrons which originate in water is prevented by the carbon dioxide.

If these electrons are now combined with hydrogen ions, i.e. protons, which are always found in water, the ions lose their charge and are grouped together as biatomic, gaseous hydrogen. Additionally, for this process a certain enzyme is necessary which, for example, from certain bacteria obtains and permits the addition of the isolated photosynthetically active membrane. In this manner an artificial system can be constructed for which the raw material water is practically limitlessly available. Sunlight too--viewed worldwide--is limitlessly available.

Since a corresponding "cell-free system" is relatively unstable--although as Benger reports it has been possible to cover isolated chloroplasts with synthetic materials--it probably makes sense to allow the production of hydrogen to occur in a "cellular" system. Certain blue Algae are, for example, appropriate for this. These organisms, which from an evolutionary point of view are very old, utilized hydrogen for their metabolism when it was still available on earth in higher concentrations. Some blue algae have maintained this capability until today, although it is impaired because of environmental conditions and only plays a secondary role in their metabolism. As Benger's experiments demonstrate, it is, however, possible to revive this capability of blue algae, which dates back to the earliest period of the development of life.

Benger and his colleagues are experimenting in Konstanz with the blue algae Anabaena nidulans. These algae consist of smaller vegetative cells in which photosynthesis occurs and to a lesser extent of larger cells in which no complete photosynthetic transport of electrons is carried out. For this they received an enzyme which is in a position to bind free nitrogen to air and to convert into ammonia.

The nitrogen-fixing enzyme, however, is not selective and also accepts other compounds. With a lack of nitrogen it also reduces protons to free hydrogen. To be sure, an additional enzyme provides that the hydrogen cannot escape from the cell by picking up the smallest quantities of hydrogen but not releasing them. The enzyme which picks up hydrogen, however, only functions in combination with oxygen. Through the employment of certain inhibitors, like some herbicides, which prevent the photosynthetic transport of electrons, it is possible to inhibit the development of oxygen and thereby to block the activity of the enzyme which picks up but does not release hydrogen. The hydrogen which develops must escape. Under these conditions the algae produce 10 times more hydrogen than when uninhibited.

To be sure, as the experiments at pilot locations have shown, after some time an undisturbed photosynthesis must again be permitted for the algae. Through an alternating "switching" of a photosynthetically active culture with an inhibited culture, however, a continuous production of gas can be achieved.

This system is, however, very far away from any large-scale application. The effectiveness of this hydrogen production must be considerably increased. Additionally, not all of the biochemical mechanisms which support this procedure are fully understood. More thorough-going basic research in the area of photosynthesis and bioenergetics is needed. Only then can an evaluation be made of the contribution which this unconventional, biological hydrogen production can make toward the future production of energy.

[illegible]
[illegible] Blue

BONN TO FUND UPDATING OF SMALL PRODUCTION LINES

Munich SUEDDEUTSCHE ZEITUNG in German 30 Jan 80 p 26

[Article: "Bonn Wants To Promote Production by Investing DM 250 Million Over 4-Year Period: Small Concerns Preferred"]

[Text] MES. Bonn. Through a new program of federal support which should make a total of DM 250 million available over a 4-year period, production lines should find it easier to introduce necessary changes and insure the capability to compete on a long-term basis. The program, "production technology," is designed primarily for small- and medium-range businesses which have less than 500 employees.

According to the Federal Research Ministry that is responsible, the guidelines assure that such businesses will receive preferential treatment, and the money will not be attracted by the large businesses with heavy capital. The manufacturers of products in question are, above all, a large number of machine builders, the electronics industry, and portions of the precision instrument and optical industry.

The program assumes that the equipment of the firms in question is noticeably in need of renewal. Basic engineering changes will be necessary within the next 10 years, above all, because of modern information and control technologies. Microelectronic units which are interchangeable and inexpensive make it more and more possible to take care of costly production processes with manufacturing devices. Demand is also increasingly characterized by a multiplicity of specialized desires from customers and by the need for manufacturers to be flexible and to be able to react quickly, as well as the need to produce products in small quantities and at affordable prices.

Research Minister Volker Hauff also designated as a goal for this program aid to keep up in a timely fashion with technological advancements and thereby avoid economic harm. The intent of the program and the sizes of the businesses in the branches of the economy involved could result in

providing two-thirds of the money to small- and medium-range businesses which have an annual sales figure ranging to about DM 150 million. It is already planned now that the support program should expire after 1983. A total of DM 44.1 million have been earmarked for 1980; in 1981 and 1982 the support will climb to DM 58.5 million and to DM 80 million; the amount will be reduced to DM 73 million in 1983.

The conduct of the program is left to the project recipient; the nuclear research center in Karlsruhe has been designated as such and will be advised by a committee of experts. Steps which could have an effect on the work force of a concern involved should be worked out in conjunction with the employees' council.

The application process should be made simple, particularly for small business, and, where possible, time-consuming reporting and evaluating procedures should be avoided. An attempt will be made not to let more than 3 months pass between the application and the decision.

9485
CSO: 3102

ANALYSIS OF FRENCH CIVIL AVIATION EQUIPMENT INDUSTRY

Paris AVIATION MAGAZINE INTERNATIONAL in French 1-14 Feb 80 pp 22-23, 25, 27, 29, 31-32, 34-36

[Excerpts] The French equipment industry in the last few years has finally reached second rank in the world even though that rank is still being challenged by Great Britain which obtains considerable business through its favorable connections with the United States and substantial profit from supplying replacement parts for equipment sold during the British industry's years of glory. What has been forged down through the years since the end of World War II has at last attained maturity, which is not without posing certain problems related to adaptation of its structures and those of the official services, and above all, perhaps, of mental attitudes.

On the technical level, which in this sector remains the basis of everything, French equipment has reached a competitive status in the world market in the principal key areas: inertial navigation, automatic piloting, digital multiplexers, and computers.

In the civil sector that maturity was demonstrated with the inception of the Airbus A-310 program, on which occasion all the French specialty companies, from makers of landing gear to instrumentation, were placed into competition with the large American companies by the aircraft manufacturers, themselves under constraint to end up choosing the most competitive equipment (approved by the airline companies) to assure the commercial success of their undertaking. Never before has so much French equipment been found on board a European civil aircraft.

In the military sector it was indeed a long time since the French industry, in large part supported by the government, has succeeded in providing the main part, let alone the total, of the equipment needed to constitute a weapons system competitive with what its British and American competition offer on the international market. While in the last 5 or 6 years technological upheavals have profoundly altered the characteristics of such equipment. The French companies are facing up to the situation in most of the areas and even though certain delays must be acknowledged, particularly as far as the first Doppler impulse radar which is to equip the Mirage 2000

is concerned, the fact remains that the aircraft, as its predecessor, will be equipped with a weapons system comparable with those of its principal rivals, and one which is completely French.

This overall competitive status is being more and more widely utilized by the companies to transcend the boundaries of France, where, incidentally, the market is shrinking.

Today, orders on the books are satisfactory for a majority of the equipment manufacturers and provide a work-load for the next 2 or 3 years. It is beyond that where things become uncertain. Many questions arise. Some of them are not peculiar to the French industry: it is a matter of reaching the production stage of the new generation of equipment and the impact of new technologies upon various factors such as distribution of the value added. Others are French alone; they are tied to the uncertainties which still weigh upon the future of the Mirage 2000 for export, as well as problems--already old indeed--of industrial structure.

By way of announcing a technological revolution for tomorrow let it be said that we are there today. The industry is approaching its most critical phase, that of industrialization. It is the moment of truth; it is there that the final accounting can be made. Even though it is still possible to be deceptive in the study stages, indeed demoralize the adversary--the American companies are past masters of that art--there can no longer be either deception or self-deception when it is time to execute contracts to provide the first equipment units.

The French industry is approaching this test in the civil domains at about the same time as the large American companies. In some cases it has a certain lead; such as the case with digital automatic piloting for commercial aircraft. On the other hand, even though it is at the head of the line, in Europe, in the military sector, there is some lag in a number of equipment items in comparison with the American competition. This dissymmetry of the situation in the civil and military domains is directly translated to the prospects and uncertainties of the companies. A number of responsible officials are expecting some difficult years, at the middle of the decade, in the military market and are preparing their firms for that eventuality.

The civil success is obviously the Airbus (although we must not forget the success of the Dassault-Breguet Falcon series or of the Aerospatiale helicopters). But it is to their own efforts above all that the French companies owe the successes they have recently achieved. In fact, even though they had in a way benefitted from the low credibility of the Airbus program at its inception to gain a place aboard the A-300 without too much competition from the large American equipment manufacturers, it was not the same in the case of the A-310. Airbus Industrie has become the second largest supplier to the airlines, after Boeing. The American companies have taken the start of its new program very seriously and have come forward in force to contest the position of the French equipment manufacturers, sometimes making large concessions in order to gain a foothold.

The principal competitions went in favor of French companies, SFENA won out over Sperry for construction of the digital automatic pilot. Thompson-CSF was selected over Collins and Sperry for the cathode ray instrumentation. Messier-Hispano-Bugatti will manufacture the landing gear for the new aircraft despite the proposals made by Menasco in association with the French EBAM firm. To achieve such results the French equipment makers had to fall into line with their competitors from across the Atlantic; not only at the technical level but also at the price level--a substantial effort when the environment in which they are working is considered. The scale effect is unfavorable and further, they are only at the beginning of their penetration into the civil market after years of having abandoned it for lack of French programs.

Some of the victories won are not final. Even though the market continues favorable for the Airbus the large American equipment manufacturers will appeal the decisions made for the basic version of the aircraft to airline customers with whom they have old and solid ties. Already, on the A-300, some French equipment occasionally has had to yield place to American equipment.

The war is not over and, thanks to their efforts, a growing number of French companies are carrying the battle into the United States itself, at Boeing. The compensation agreements in connection with Air France purchases are promoting this activity, but the French equipment makers must prove to be competitive. Such has been the case for SFENA, Jaeger, TRT, Intertechnique, and SAMMA, all of whom have gained a place in the new Boeing 757 and 767 programs. Other French companies have introduced themselves at Seattle in other civil aircraft programs: Messier-Hispano-Bugatti, Brion-Leroux, and so forth.

Although civil prospects are good as far as the volume of business is concerned, the imperative need to be competitive is tending to reduce profit margins. The evolution of technology is going in the same direction, as well as monetary and economic mechanisms.

Competition is resulting in lower prices. The digital technology which has been adopted is showing up in a flow of the value added upstream, that is, toward the manufacturers of the integrated components. The disparity between the French and American inflation as well as the continued decline of the dollar show up in a loss of competitive position already evaluated, at the end of November at about 11 percent for the last 16 months.

It is understandable that under such conditions some are sometimes talking of a Pyrrhic victory. Without going that far one may will wonder about the investment capabilities (in production facilities and studies) which will actually be derived from civil business. In fact, it certainly seems that it will take still a few more years before the French industry's position in the civil market will be established and enable it to go its way alone. At the moment we are still at the stage of reconstituting (or even constituting) a civil trade fund which was abandoned after the Caravelle program, an operation which needs support.

The year 1979 was replete with events in the equipment sector, as our readers have been able to learn from the series of articles which we have published. For the record let us recall the new range of autopilots for helicopters by SFIM, the cathode ray instruments (EFIS) of Thomson-CSF, the Airline 2000 radio equipment range developed by EAS, the distance measuring equipment (DME) developed by TRT and adopted for the A-310, and the landing gear for that aircraft due to Messier-Hispano-Bugatti. On the military side, the principal developments have revolved around the system for the Mirage 2000, flights test of which are continuing throughout the year (computer and DTD digibus, SAGEM inertial system, SFENA autopilot, and Dassault electrical flight controls, among others). But the year was also marked by development of optronic equipment in particular the FLIR developed by TRT.

The year 1980 will be no less interesting than the one just past. Among the programs which should surmount important steps in their development there may indeed be cited the SU2 "strapdown" navigational systems of SAGEM and SFIM, the SFENA digital autopilot, the Thomson-CSF EFIS instruments which will fly aboard the Airbus No 3, and the cartographic display system derrived from the ICAR developed by Thomson-CSF for the Mirage 2000. Further, there may be noted the flight tests, in the spring, of the Mirage 4000 with active piloting of the canard surfaces with which it is fitted. Following pages will put the spotlight on several of these programs underway which will contribute to strengthening of the international position of the French equipment industry. A brief look at each of the principal sectors will enable these developments to be better placed in context.

Integration and Piloting

With the CITRA digibus digital multiplexing system of the Mirage 2000 France has available the only system of this type developed outside the United States. It is to serve as the basis for all future integrated military systems to be constructed.

In the civil domain exchanges over bus lines is the subject of an international standard, ARINC 429. EAS, in cooperation with SFENA, has developed an adapted interface circuit, designated the ILA (ARINC interface logic), industrial production of which has been assigned to EFCIS, a subsidiary of CEA and Thomson-CSF. Another circuit which enables the data from several buses to be received has also been defined by all the interested equipment manufacturers and constructed by EFCIS. This circuit has been designated the RTA (ARINC buffer receiver).

SFENA in the case of airplanes and SFIM in the case of helicopters have established solid bases in the area of automatic pilots. Elsewhere we spoke of the digital equipment for the Airbus, but SFENA is constructing the autopilots for all French combat aircraft. In the last few days of 1979 the first flights of the PA 205, intended for the Jaguar, took place. It is a very simple apparatus (maintaining attitude and altitude, heading, automatic fore and aft trim control, and assisted trim in roll) intended for relief of the pilot during missions of long duration.

SFIM, by virtue of the success of Aerospatiale's helicopter division is little by little taking the lead on the civil market (visibility flying regime and instrument flying regime) after having done so with military machines. SFENA is continuing its activity in this area where it has met with success in the United States, with Bell.

Navigation

In the domain of autonomous systems France has never before been so well situated as much for the present (SAGEM system of the Super-Etendard and of the Mirage 2000) as for the future (strapdown system). On the other hand SAGEM has for the present abandoned any intent to compete with American suppliers of inertial systems for civil aircraft.

Radionavigation and Radio

For a long time confined to the military sector the French industry is now beginning to have increasing success in the civil market. TRT has developed the TDM 709 DME and from it is deriving a transponder. For its part EAS is now proposing a complete range of radio equipment for commercial aviation, the Airlines 2000, conforming to the standard ARINC 709, comprising a VHF [very high frequency]/COM (TTR 2100), VOR [omni-range radio beacon]/maker (DVR 2200), and ILS [instrument landing system] receiver (ILS 2300), DME (DME 2400), transponder (ATC 2500), automatic radio compass (ADF 2600), and the associated control units. Last, for the A-310, an on board digital intercommunications system by TEAM has been adopted.

TRT occupies a foremost worldwide position in the domain of military and civil radioaltimeters, shown concretely by the selection of one of its models by Boeing for the 757 and 767.

In the general aviation domain Badin-Crouzet has available a range of competitive VOR (BCR 300) and VHF/COM (BCR 720) and, with the support of STNA is developing a DME which should be commercially marketed this year. For its part EAS has completed the Migrator range for twin engine aircraft.

Crouzet is continuing the work of optimizing the logic for the Omega navigation system originally due to SERCEL. The company is finishing development of the Nadir autonomous system adopted for the ALAT and planned for the Transall.

SOCRAT, TRT, and EAS are offering equipment for military communications and are sharing the market.

Instruments

Besides Thomson-CSF, which right off is seen raised to the international scale with its cathode ray instruments, the French position remains excellent. SFENA has taken the lead as foremost worldwide supplier in the field of stand-by horizons equipment. Selected as the supplier of the main piloting instruments for the A-300 (including those for Eastern Airlines) it has developed electrochemical instruments with digital inputs for the A-300 and A-310.

In the area of motor control instrumentation Jaeger has made remarkable penetration, on which we have reported in our preceding issue.

SFIM is keeping its position with military aircraft; in particular it is providing an all-position piloting indicator for the Mirage 2000.

On Board Radars

Two companies essentially are sharing a market which remains very closely tied to the success of French military aircraft. Thomson-CSF is developing a multifunction Doppler radar (RDM) for the multipurpose versions of the Mirage 2000, that is, mainly for export. In collaboration with EMD the company is continuing to develop a Doppler impulse radar (RDI) intended for the Air Force's air defense Mirage 2000. Started late, this program is somewhat out of step with the aircraft program and at the moment constitutes a weak point.

EMD, in collaboration with Thomson-CSF, is working on the Antilope IV radar which is to equip the penetration version of the Mirage 2000.

The two companies are also cooperating in production of the Agave radar with which the Super-Etendard is equipped.

Thomson-CSF has developed, for naval air operations, an entire series of radars around a basic version named the Iguane (see our preceding issue) and is trying to export directly certain versions of this radar with which the ANG and remodelled Alize will be equipped.

OMERA (which belongs to the same group as TRT) for its part has specialized in the domain of radars for equipping naval helicopters. The ORB-32, in particular, is the basis of the Super Frelon/Exocet system. It has very recently developed a new model, the ORB-37, with which the new Transall aircraft of the Air Force are to be equipped.

Optronics

This is a new domain in which the French companies are making a good showing. TRT has developed the Mina 2 telescope which enables the Milan antitank missile to be fired at night, a capability unique in the world at present.

In addition TRT has developed a reconnaissance FLIR adopted for the ANG and a thermal camera (Hector) which is the basis of the night firing system for the HOT antitank missile from the Dauphin helicopter.

For its part SAT, which worked in cooperation with TRT on the modular thermal television system adopted for the ANG, has developed an optronic reconnaissance system (Corsair) intended for the tripartite (Canada, Federal Republic of Germany, and France) CL-289 reconnaissance missile.

Landing Gear and Hydraulics

Messier-Hespano-Bugatti (MHB) puts France in good position as far as landing gear for large civil aircraft (Airbus) and military aircraft (all French airplanes) is concerned. The company has gained a number of contracts in foreign countries and is participating in several American programs. For example, it is supplying parts of the equipment on the Boeing 747 and 737 and by virtue of its cooperation with Cleveland is participating in the DC 9 Super 80 program.

Its policy of cooperation with the leading European companies has enabled it to participate in a number of foreign programs (S-211, G-222, and G-91).

To meet the expansion of its civil activities, which now amount to 45 percent of its total business (720 million francs) and which will exceed 50 percent in 1981, MHB has committed very large investments which will make its Bidos plant the foremost in Europe in this domain.

MHB also occupies a leading place worldwide in the area of pumps, along with Vickers and Abex.

At the same time MHB is maintaining the position it has gained as a supplier of wheels and brakes. On the civil market (Airbus) it must face the pressure from Bendix which little by little is supplanting all its competitors, American and others, on large aircraft.

The second French landing gear company, ERAM, is but a tenth as large as MHB, which employs 3,100 persons, but it has achieved remarkable results in exports. It studied, and is producing the landing gear for the Brazilian Xingu and Bandeirante aircraft, and is conducting a dynamic policy of seeking foreign markets. The success of the Brazilian aircraft has decided it to double its capacity in 1980.

In addition ERAM is constructing the landing gear for the Dauphin helicopter, the landing gear series of the Fouga 90, and numerous hydraulic components intended for the AS-332, WG-13, Alpha-Jet, A-310, and Falcon 20H.

To these several large sectors of on-board equipment there must be added all the ground equipment directly related to aeronautical activity, in particular, the equipment of the radio infrastructure: air traffic control radars and air defense radars, along with associated operating equipment, and navigational and landing aids, in which France, mainly because of Thomson-CSF (but also of companies such as SINTRA and LET) has for long been well situated.

Digital Automatic Piloting

Following a vigorous competition with its principal American rival, SFENA has finally been selected to supply the digital autopilots for the Airbus A-300 and A-310. At the end of this year flight tests with the Airbus No 3 will begin at Toulouse. In 1981 this equipment will be the first digital autopilot in the world certified to effect Category III approaches.

Based upon the 16-bit Intel 8086 microprocessor, the Airbus digital autopilot (PA) comprises five [as published] electronic units: Two FFC (Flight Control Computers) which take over the function previously performed by the PADV [Direct Vision Autopilot?] and two FAC (Flight Augmentation Computers) which constitute the automatic throttle (N 1 and EPR).

The construction has been studied so as to effect standardization of the electronic cards. In fact the entire appratus is built around four types of cards: an ARINC control card, a memory card, a conversion card, and one called the CPU (Central Processor Unit). Each computer includes two of each card.

In the cockpit the controls are grouped upon in an arc on two mode indicators.

To guard against breakdowns of the logic the two piloting systems have been made completely dissymmetrical and in addition they employ different languages and clocks. As the certification tests draw near it indeed seems that most of the problems in the effectiveness of the logic, which were still present 2 years ago, are resolved.

At the end of April a first Airbus digital PA will be assembled for tests in a simulator. This summer the Airbus No 3 will be equipped and flights will begin at the end of the year. The first "digital" aircraft will be the first Airbus delivered to Garuda, the Indonesian company; this constraint has led to establishment of a particularly tight program.

The PA which will fly later aboard the first A-310 will be practically the same as that of the A-300 except for modifications to the TCC to accomodate electronic equipment with which the new motors will be fitted.

In 1981 the Airbus will no longer be the only large airplane to fly with a SFENA digital PA. Within the scope of the New Generation Atlantic (ANG) program the company is developing a digital PA with similar technology (16-bit microprocessors) specially adapted to that aircraft's maritime patrol mission.

Involved here is a single system, with overall surveillance. This solution, which represents a system capable only of approaches in Category I is, on the other hand, well adapted to the essential problem of the ANG, low altitude flight (maintaining radio altitude above the sea). Another special feature of the digital autopilot of the ANG is the capability of using practically all sources of navigational data--DME, VOR, TACAN, INS, and so forth.

In comparison with the present analog autopilot of the Atlantic the new PA, which performs the same functions, should contribute a large gain in reliability, which will show up as availability greater by a ratio of 5 to 10 and improved safety.

The year 1980 is to be devoted to bench integration tests; flight tests will begin at the same time as those of the aircraft, in the beginning of the summer of 1981.

The Era of "Strapdown" Systems

The year just beginning will be marked by flight tests of three inertial systems with linked components ("strapdown" in American terminology). SV2, a subsidiary of SFENA and Crouzet fired the first shot in the final days of 1979 by flying a laser geometry system. In the spring it will be SEGEM's turn with a system using dry gyroscopes dynamically suspended. SFIM for its part should be ready to proceed with tests of a system also using dry gyroscopes, of its own design, of the GAM series. Outside of the United States only the French industry has mastered the technologies which enable such equipment to be constructed. The fact that three companies have almost simultaneously reached the stage of testing it in flight is significant both for the technical level attained and the completion which has been opened on the national scale upon the occasion of the appearance of new technologies, those which will show in the years to come whether an industry is competitive or not.

Now the traditional supplier of inertial navigation equipment for all the French military programs (aircraft, and strategic and submarine missiles), SAGEM is obviously well situated to tackle development of new generation equipment. In addition, it is compelled to scour all possible avenues to maintain its position.

Having obtained excellent results with its dry gyroscopes with dynamic suspension (GSD), SAGEM has for several years been working on the construction of a linked component system using those elements. These gyros, equipped with a torque motor enabling them to be used as rate gyros in angular velocity regimes between 0 and 30 degrees per second, are well adapted to such application.

At the end of last year a GSD version designated 031, adapted to construction of a strapdown system by its characteristics of "fixed torque" drift, underwent intensive tests; however, a new version, GSD 032, was under construction. The observed performance justifies the expectation, for the strapdown attitude system constructed around the new GSD, of performance which can be summarized as follows: attitude error 0.1 degree (1 sigma), headway error (in the gyrocompass) 1.5 degrees (1 sigma), and heading drift less than 0.5 degree per hour.

Two prototype systems have been built and bench tested in the company's Pontoise plant. They employ two GSD and three inertial type accelerometers (Model A-310) also developed by SAGEM. At the moment it is a matter of validating the principle and evaluating the performance of a linked component, dry gyroscope system. Physically the present system consists of two cabinets, one containing the inertial components and associated electronics, the other the computer and servo electronics. The first system, designated MSD 01 (equipped with GSD 031 gyros), during laboratory tests demonstrated characteristics which, transformed into navigational terms, correspond to a position error on the order of 15 nautical miles per hour.

Laboratory experimentation is not precisely representative of operating conditions in flight in spite of the highly perfected bench which SAGEM has available. Teh company now estimates that actual installation aboard a helicopter, for example, at the worst is capable of degrading performance by a rate of 2. As a matter of fact, various phenomena combine to make a precise estimate difficult, hence the necessity of going on to test flights. These will be accomplished beginning next March or April. An MSD 01 system will be installed upon the Caravelle 116 of the Flight Test Center (CEV). At the same time the other prototype system, installed upon a ground vehicle, will undergo tests at the Ballistic and Aerodynamic Research Laboratories (LRBA).

One of the key points in obtaining high performance resides in the precision of the torque motors of the gyroscopes (whose scale factor must be about 1/100000). The improvements contributed by the GSD 032 and its associated electronics will make it possible, according to the responsible program officials, to attain navigation performance on the order of 10 to 20 nautical miles per hour position error. A system with performance of this class combined with a navigation Doppler make it possible to build a hybrid system capable of performance on the order of several nautical miles per hour, that is, particularly suited for tactical helicopters.

This equipment should be able either to effectuate a completely autonomous alignment by observation of the speed of the earth's rotation (gyroscopes function) in 3 minutes or to proceed to a quick alignment in less than 1 minute by using an external source (as a magnetometer, for example). In addition, the intrinsic performance of the inertial components make it possible to contemplate, in the event of trouble with the Doppler, autonomous navigation for another half-hour.

"Exotic" Gyroscopes

Dry gyrotechnology has permitted development of equipment intended for all vehicles, helicopters, airplanes, and missiles, with a class of performance up to about 5 nautical miles per hour. It makes it possible to think of autonomous navigation--short term and indeed medium term (up to 1 hour of flight). Other technologies make it possible to achieve the same results, or to do much better. SAGEM is exploring them also.

For a little more than 2 years the company has been experimenting with a laboratory model of a laser rate gyro. The main purpose is to gain sufficient mastery of the bottlenecks in this technology, in particular of course, construction of magnetic mirrors making it possible to eliminate the mechanical movement putting the gyro into rotation in order to get away from the blend zone. By the end of next year the studies now in progress should result in construction.

The preferred path for SAGEM in constructing future high performance systems seems to be use of gyroscopes with electrical suspension (GSE). Such gyros consist of a perfectly spherical ball suspended within a concentric cavity

by means of electrical fields. Rotating without friction, this gyroscope should enable very high performance to be achieved. In order to know the position of the ball in space an unbalance is created by a metallic deposit at a point on its surface and the position deduced from the currents which must be applied to maintain it in suspension. The ball is about 1 centimeter in diameter.

Several feasibility models of electrically suspended gyros have been built by SAGEM in the last few years. An evaluation of the GSE took place in the LRBA at Vernon in the second half of 1979. Some time from now such gyros should lead to construction of linked component systems in the 3 nautical miles per hour class. But, in the end, at SAGEM they are thinking of distinctly superior precision: first, 1 nautical mile per hour, and later on 0.2 to 0.3 nautical mile per hour (which is 300 to 500 meters per hour), by using the GSE, not for strapdown systems but operating them in systems of the "carrousel" type, or of conventional type with servo platform.

Up to now studies of the GSE have had the benefit of support from the DRET. They may shortly be the subject of an exploratory development contract with the STTE (formerly the STAE) with the objective of 1 nautical mile per hour.

Further, SAGEM is interested in anotner category of components--magnetic resonance gyroscopes. Their principle has been known for a long time. Experiments with it were conducted in the 1960 decade in the laboratory of the Ecole Normale Superieure on the rue d'Ulm. It involves orienting, by optical pumping, the spin of the atoms of mercury isotopes contained in a cell. Unfortunately collisions with the walls of the cell which confines the mercury vapor disorients the spin of the atoms. The phenomenon is exponential and determines what is called the relation [sic; relaxation?] time. That point is the key for these components. In order to obtain performance in the class of 1/100 degree per hour it is necessary to wait for relaxation times on the order of 100 seconds. This is the objective fixed in a contract with the DRET which should very shortly be awarded to SAGEM.

If the relaxation time problem is resolved magnetic resonance gyros could combine the advantages of mechanical gyros and laser gyros without any of the disadvantages, but that is still very far off.

The Cost of Redundancy

However attractive the principle of linked component systems and the new gyroscope technologies in the process of development may be, the benefits conferred upon the costs of equipment are not always evident. SAGEM has devoted itself to an entire series of theoretical comparisons whose results can be rather simply summarized. Strapdown systems permit only marginal cost advantages if compared one for one with conventional platform systems. The advantage is on the order of 6 percent. On the one hand, when "fail safe" ensembles are not sought, but rather "fail operatives" redundant ensembles, the advantages become very large: 30 percent for a system operational after a single breakdown, 45 percent for a system which can withstand a double breakdown. In the first case the comparison is between a strapdown ensemble of three gyros, four accelerometers, and two computers and between a fully

duplicated conventional system; in the second, between a linked system comprising four gyros, five accelerometers, and two computers and a conventional system in triplicate.

These differences arise from the fact that by cleverly orienting the gyros it is not compulsory to add two more each time to pass to a higher level of redundancy; one is enough.

Within the scope of a technical service contract the company is going to develop a strapdown system with three GSD and six accelerometers. Designated TSD 01, this redundant system with six sensor axes will have logic capable of reconfiguring it in the event of breakdown upon one axis. Without doubt this is one of the most promising paths for the strapdown technique.

Like its French competitors SAGEM is proposing its models for the military programs which should materialize in the 1980 decade: the French-German PAH-2/HAC armed helicopter, missiles, and the CT 92 (the successor to the Jaguar) for which a GSE system in the class of several tens of nautical miles per hour is foreseeable, considering the time schedule.

11,798
CSO: 3102

STANDARDS,QUALIFICATIONS FOR RESEARCHERS ANNOUNCED

Paris AFP SCIENCES in French 24 Jan 80 p 1

[Text] The JOURNAL OFFICIEL published on 19 January (announced in Bulletin 202) the new statutes for researchers of the National Scientific Research Council (CNRS) and the National Institute of Health and Medical Research (INSERM). Those concerning the third great public research agency, INRA (National Agricultural Research Institute) will only be published much later, since certain provisions of the bill must be examined by the State Council.

In the two organizations, the researchers are classified in the following successive posts: "attache de rechereche" (research assistant), "charge de recherche" (in charge of research), "maitre de recherche" (research master), "directeur de recherche" (research director). For CNRS (but also for INSERM, with a few slight modifications), the conditions of appointment to the posts are as follows:

--The applicant to the post of attache de recherche must prove his ability to carry out research.

--The applicant to the post of charge de recherche should have proved his ability to work as researcher, and should therefore have to his credit recognized scientific work, ratified in particular by a thesis for the degree of doctorate.

--The applicant to the post of maitre de recherche should have proved his ability to contribute to scientific progress, to conduct personal research or inspire a research group.

--The applicant to the post of directeur de recherche should be internationally recognized, and be able to direct the conduct of research, a laboratory or a research group.

As foreseen the two decrees stipulate precise rules for selection and promotion according to agencies and levels. They also have provisions for invention rights.

9018
CSO: 3102

OPEN LETTER FROM RESEARCHERS TO PRIME MINISTER

Paris AFP SCIENCES in French 24 Jan 80 pp 1-2

[Text] In an open letter to the prime minister, several hundred researchers, engineers, technicians and administrative personnel ask for the suspension of the decrees reorganizing the National Scientific Research Center (CNRS) and modifying the statutes of the researchers.

In their "solemn appeal" published on 19 January, the signatories condemn on one hand "the measures attempting to define officially the privileged directions of research" and on the other hand, those "imposing a rigid mold to the course of the career of researchers."

The signatories, including more than 300 directors, research masters and lecturers express, in particular, the fear that "if the contemplated measures were applied, they might seriously compromise the future of fundamental research in France." They say that they "cannot understand why their activity should be violently criticized today, when they were able to bring French research to the international level."

"If it is necessary for a nation to define research policy, it should leave great room to initiative of the scientific researcher for fear of sterilizing creativity," the signatories also declared, addressing their letter on the eve of the publication in the JOURNAL OFFICIEL of the decrees defining the new statutes for researchers of CNRS and INSERM [National Institute of Health and Medical Research].

9016
CSO: 3102

SOME DECISIONS NECESSITATED BY NEW ENERGY POLICY

Paris AFP SCIENCES in French 24 Jan 80 p 10

[Text] Mr Andre Giraud, minister of industry, presented on 23 January to the Council of Ministers a communication on the results of the energy policy in 1979 and the first decisions for the adaption of this policy, necessitated by recent oil price hikes.

The development of the national productivity in the sector of hydrocarbons and prospections of the French territory and its economic maritime area will be encouraged. In 5 years time, the land and maritime prospections of the national territory will represent more than 5 billion francs of investment, according to the communique issued by the Council of Ministers.

The consumption of coal in industry and collective heating will be developed in particular by means of financial assistance of the Agency of Energy Conservation and a research and development program aiming at the modernization of the techniques of handling and utilization of coal. In this connection, the Council of Ministers decided to create a new 600 MW thermal power station in Gardanne, for the purpose of developing the coal resources of the Provence basin.

Meanwhile, the minister of agriculture, Mr Mehaignerie, and the minister of industry, promoted the adoption within the framework of solar policy, the first elements of the "green energy policy," whose principle had been decided at the time of the last annual agricultural conference.

9018
CSO: 3102

ALFA ROMEO MARKETS TURBOCHARGED DIESEL CAR

Turin ATA in Italian Nov 79 pp 434-436

[Article by Et. C.: "Alfa Romeo Alfetta 2.0 Turbo Diesel"]

[Text] Next January, Alfa Romeo will launch the Alfetta 2.0 in the turbo-diesel version on the Italian market.

The Alfetta 2.0 Turbo Diesel is based on the body of the 2000 L sport sedan, from which it is distinguished by the additional air intake under the radiator grill and the emblem "Turbo D" on the trunk lid. Fittings and equipment remain the same, including the fact that it has an RPM counter--something that is quite exclusive in the equipment of a diesel automobile.

The engine is a four-cylinder in-line VM (Finmeccanica) of 1,995 cm^3 (88 X 82 mm), with several interesting construction features: block of "tunnel" cast iron with cylinder-dividing walls that extend all the way to the oil pan, forming thick ribs into which are inserted the five engine-shaft supports; inserted cylinder liners; four separate cylinder heads, of light alloy; camshaft in-block (reducing vertical bulk).

The turbosupercharger is a KKK which compresses the intake air to 85 kPa, a value that is kept constant at 2,600 RPM and higher. Bosch rotary injection pump.

Auxiliary mechanical pump for automatic draining of the injection apparatus.

Power developed is 60 kW-DIN (82 HP) at 4,300 RPM. Maximum torque, 162 Nm (16.5 kgm) at 2,300 RPM. The engine mass is 200 kg. This is 60 kg more than for the gasoline-powered 2000. Five-speed transmission, with the first four ratios close together (0-115 kph, approximately), and the fifth a power ratio (155 kph).

The suspension system is set in function of the total increase of 1,000 N which loads mainly the front wheels. The firewall, the steering-wheel housing and the engine hood are carefully insulated with sound-absorbing material.

The engine is covered by Alfa Romeo's 24-month guarantee, up to 100,000 km.

Structure of the Alfa Romeo VM System

The engine block is formed of a single casting of special alloy with cylinder-dividing walls that extend all the way to the oil pan, forming thick "ribs" where the mechanical forces are predominantly concentrated.

The crankshaft is inserted in the cylindrical holes made in these dividing walls; it rests on aluminum plates and therefore does not need main bearing caps. The locking of the plates is produced automatically by the difference in coefficient of thermal expansion between the cast iron of the block and the aluminum of the plates.

The shaft, of special Ni-Cr-Mb steel, rests on five thin shell bearings, covered with antifriction metal. The liners, of special alloy, are in direct contact with the cooling fluid; in them run light-alloy pistons of high heat resistance, with three piston rings. The connecting rods, of pressed steel, have journals with antifriction bronze on their feet and thin shell bearing on their heads; their dimensions are such as to permit removal of the pistons and rods from above, simplifying and facilitating tear-down.

The light-alloy head consists of four identical elements, one for each cylinder. THis particular "modular structure," with separate heads, mades the thermal deformations of the head independent from those of the block and makes distribution of the cooling liquid more manageable.

The combustion prechambers and chambers, of the Ricard Comet V type, are formed in the head.

The valves are in the head, side by side and parallel, opened and closed through rods and rocker arms moved by a camshaft in the block whose action is controlled by appropriate gearing.

Thanks to its original architecture, the Alfa Romeo VM System is one of the lightest engines in the 2-liter category.

Supercharging

In a gasoline engine, adoption of a turbosupercharger is conditioned by the detonation phenomena: in order to have the advantages of supercharging, the technicians are forced to reduce the geometric compression ratio. In diesel engines, though, the greater the pressure in the combustion chamber, the easier it is to ignite the fuel. The increased pressure makes for improved thermal efficiency--that is, lower specific consumption.

The diesel engine's characteristic of accepting very poor mixtures, with excess air up to 50 percent, makes it possible to reach high supercharging ratios without having to increase the quantity of diesel fuel injected at

the same time. In the case of the Alfa Romeo VM system, maximum supercharging is 85 percent, while the fuel increase is only 40 percent.

The turbosuperchargers adopted are of the "K 24 C" series. In them, the turbine is capable of recovering approximately 70 percent of the residual energy of the exhaust gases. Even when the engine is turning at only 1,500 RPM, the supercharger puts out a 20-percent supercharge. It reaches the 85-percent maximum at 2,600 RMP and stays constant at this value to the end of the curve.

A control device (waste gate) makes it possible to regulate the exhaust-gas flow into the turbine by measuring the supply pressure reached by the compressor.

The turbine-compressor set, which has no mechanical organ in contact with the rotating parts of the engine, is lubricated under pressure by the oil from the lubricating circuit.

An air-flow sensor measures the pressure reached by the compressor in the intake tubes, and by gradual regulation, adjusts the quantity of diesel fuel injected into the cylinders. This device acts in release also, immediately stopping the fuel flow as soon as the foot is raised from the accelerator.

In conclusion, the system of supercharging by means of a turbosupercharger as adopted by the Alfa Romeo VM System makes it possible to obtain very high power (60 kW) from a moderate displacement (1,995 cm^3) without negative trade-offs, thus reducing specific consumption and increasing the overall lifetime of the engine.

These are factors that suggest development of the use of automobile diesel engines based on trubosupercharging.

Noise and Vibration Filtering

The Alfetta 2.0 Turbo D has been built with special attention to insulation of the interior against vibrations and noise.

The cylinder-dividing walls, which extend all the way to the oil pan, constitute a effective shield against sound vibrations.

Just as important for reducing vibrations and noise are: the separate conformation of the head of each cylinder; the stiffness of the crankshaft, which is fitted with four counterweights and five main bearings, capable of maximum distribution of the stresses of the masses in an alternate manner; and the lightness of the connecting rod-piston set.

Other soundproofing is the shielding of the walls of the engine compartment by means of sound-absorbing panels 10 mm thick. Finally, in addition to this there is the same double damping layer, completely lining the interior, as in the Alfetta 2000 L.

Mechanical Equipment and Bodywork

The Turbo Diesel Alfa Romeo VM System has not necessitated any modification of the Alfetta's body except for those variations required by the differences in bulk and the specific characteristics of the diesel engine installation.

There are modification of the engine compartment and the forepart of the body, to make the space for the new radiator also; the battery (277 kC) and the filters have been changed, and several louvers have been added (in particular, two additional air intakes under the front bumper).

The exhaust and cooling installations are new, as are the fuel tank and the accelerator control; the gear ratios are different, and the instrumentation for the electrical installation has been modified: in particular, the starter warning light has been replaced by the starting lamp.

Test-Drive Impressions

We drove about 200 km at the wheel of the Alfetta Turbo D over a very varied course in Tuscany.

Like all Alfa Romeos, the Turbo D too offers quite exclusive performance levels for its category. It is a feisty car, at least from 2,000 RPM on, when the turboblower goes into action. The firing remains sustained throughout the entire range of engine use, and acceleration is quick, thanks also to the accurate selection of gear ratios. Response to action on the accelerator is surprisingly quick. Elasticity in the longer runs and uphill is excellent.

Behavior at lower speeds is less brilliant, though.

Between 1,000 and 2,000 RPM, power output is restricted by the relatively small engine displacement. At minimum speed, the noise (in the inteior also) is the characteristic diesel noise, but the vibration filtering is effective. At normal speeds, though, noise is kept down, but has a sound quality that strangely recalls that of the gasoline-powered 2.0 engine. Road-handling qualities are always excellent, even though they are characterized by a definite understeering tendency which makes the car less manageable on curves but more secure in directional stability.

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